172253

0000239

ENDANGERMENT ASSESSMENT

KUMMER SANITARY LANDFILL

NORTHERN TOWNSHIP, DRINKING WATER OPERABLE UNIT, BELTRAMI COUNTY, MINNESOTA

APRIL, 1985

ENDANGERMENT ASSESSMENT

KUMMER SANITARY LANDFILL

NORTHERN TOWNSHIP, DRINKING WATER OPERABLE UNIT, BELTRAMI COUNTY, MINNESOTA

INTRODUCTION:

As discussed in the Record of Decision (ROD), Northern Township is a predominantly residential community on the northern border of Bemidji, Minnesota. In May, 1984, the Minnesota Pollution Control Agency (MPCA) staff discovered volatile organic hydrocarbon (VOH) compounds in shallow residential wells downgradient from the Kummer Sanitary Landfill, which is located in the township. Since that time, the MPCA has sampled 71 residential wells for VOH compounds in the hydrologically downgradient area between the landfill and Lake Bemidji. This area is approximately one mile by one-third mile and is considered the "affected area" having an estimated current population of 960 persons and future population of 2,241 persons.

This endangerment assessment is based upon the VOH compound analyses for individual homes in the affected area. At present all of the homes and businesses in the affected area have a private well. Generally, the wells tested were shallow, from 15 to 60 feet deep and installed in glacial outwash sand. A hardpan, interpreted as clay or a clay and gravel mixture from conversations with local well drillers, is mentioned by many of the homeowners as a barrier in the soil. However, the continuity of this hardpan and its role in preventing contaminant migration downward through the outwash is questionable.

ASSESSMENT:

A review and compilation of the existing information has revealed that of the 71 homes tested, 35 homes have at least one volatile organic hydrocarbon in their drinking water supply well. Seven homes have more than ten different VOH compounds and seven additional homes have more than five different VOH compounds. There are many variables associated with the contaminated wells, some of which are listed below:

1. Distance from probable source
2. Depth of well
3. Located above or below hardpan
4. Methods of installing wells
5. Years since well installed

The affected area has individual private wells and not an overall municipal water supply system with high capacity wells. There are a number of variables associated with these individual wells; therefore, a set of assumptions must be made about the study area so that there is a common point of reference. For the purposes of this assessment, the following assumptions have been made:

Assumption 1: The Kummer landfill which opened in 1971 and closed in 1984 is the probable source of contamination based upon existing data.

Assumption 2: All of the wells located 4500 feet east of the landfill are uncontaminated.

Assumption 3: The leading edge of the leachate plume is moving 300 to 500 feet per year based upon soil permeabilities and the distance traveled to date. For calculation purposes, 400 feet per year will be used.

In addition to the above assumptions, a methodology to conduct the endangerment assessment required development. Since the types and concentrations of compounds vary from one well to another, the affected area has been separated into four groups of homes based on distance from the landfill as outlined below:

Group I - Within radius of 1500 feet of landfill, 10 homes or businesses

Group II - 1500 - 2500 feet from landfill, 172 homes or businesses

Group III - 2500 - 4500 feet from landfill, 116 homes or businesses

Group IV - 4500 - 5000 feet from landfill, 62 homes or businesses

Within each of these four groups, a worst case water quality condition has been developed by using the highest concentration of each VOH compound found in wells

located within the group. It is assumed that the health risks for compounds in each group are additive.

For each group identified below, the following tables and calculations have been developed:

1. Identification of the VOH compounds detected which exceed established 10^{-6} Health Risk Limits (Water Quality Criteria and CAG's references attached) the highest concentration detected and the calculated excess risk;

2. Identification of the VOH compounds detected which do not have established 10^{-6} Health Risk Limits and the range of concentration found.

Group I

VOH Compounds Compared with Established 10^{-6} Health Risk Limits

Compound	Highest Concentration (ug/l)	Established 10^{-6} Health Risk Limit	Calculated Excess* Risk at the 10^{-6} Level	
Methylene chloride	46.0	.19	242	halomethanes
Trichlorofluoromethane	5.6	.19	29.5	
Chloroform	1.8	.19	9.4	
1,1 Dichloroethylene	1.7	.23	7.4	
1,1,2,2 Tetrachloroethylene	25	.8	31.2	
Benzene	.70	.66	1.0	
1,2 Dichloroethane	3.80	.94	4.0	
1,1,1 Trichloroethane	6.10	22.0	0.2	
1,1,2 Trichloroethylene	3.7	2.7	1.4	
		Additive Excess Health Risk	326	

* NOTE: Excess Risk calculated by: $\frac{\text{Highest Concentration}}{\text{Established Health Risk Limit}}$ = Calculated Excess Risk

The additive excess health risk associated with drinking water from the worst case water supply in Group I is 326 x 10^{-6} or 3.3 excess cancer deaths per 10,000 population.

In addition to the calculated additive risk for these compounds having established health risk limits, five VOH compounds were identified which do not have established health risk limits. The compounds and range of concentrations found in this group are listed below.

Compound	range in ug/l
Ethyl ether	0 - 43.0
Tetrahydrofuran	0 - 83.0
1,1 Dichloroethane	1.20 - 5.40
Cis-1,2 Dichloroethylene	0.2 - 27.0
1,2 Dichloropropane	0 - 1.20

Group II

VOH Compounds Compared with Established 10^{-6} Health Risk Limits

Compound	Highest Concentration (ug/l)	Established 10^{-6} Health Risk Limit	Calculated Excess Risk at the 10^{-6} Level	
Methylene chloride	19.0	.19	100	halomethanes
Trichlorofluoromethane	1.60	.19	8.4	
Chloroform	.80	.19	4.2	
1,2 Dichloroethane	.50	.94	0.5	
1,1,1 Trichloroethane	1.30	22.0	---	
1,1,2 Trichloroethylene	.40	2.7	0.1	
		Additive Excess Health Risk	113	

The excess additive health risk associated with drinking water from the worst case water supply in Group II is 113 x 10^{-6} or 1.1 excess cancer deaths per 10,000 population.

Other VOH's without health risk limits assigned to them but detected in Group II are:

Compound	range in ug/l
Ethyl ether	0 - 2.0
1,1 Dichloroethane	0 - 2.80
Cis 1,2 Dichloroethylene	.20 - 1.20
1,1 Dichloroethylene	0 - 0.30
1,2 Dichloropropane	0 - 0.20

Group III

VOH Compounds Compared with Established 10^{-6} Health Risk Limits

Compound	Highest Concentration (ug/l)	Established 10^{-6} Health Risk Limit	Calculated Excess Risk at the 10^{-6} Level	
Methylene chloride	5.9	.19	31	halomethanes
Trichlorofluoromethane	.5	.19	2.6	halomethanes
1,2 Dichloroethane	.30	.94	0.3	
1,1,1 Trichloroethane	.50	22.0	---	
		Additive Excess Health Risk	33.9	

The additive excess health risk associated with drinking water from the worst case water supply in Group III is 33.9 x 10^{-6} or .34 excess cancer deaths per 10,000 population.

In addition to those VOH's with established health risk limits the following VOH's are present in wells in Group III but have no health risk limits assigned to them:

Compound	range in ug/l
1,1 Dichloroethane	.20 - .70
Cis 1,2 Dichloroethylene	0 - .30

Group IV

Group IV wells include those greater than 4500 feet from the Kummer landfill. To date, the selected wells tested in this group have not indicated the presence of volatile organic hydrocarbons.

FUTURE HEALTH RISKS

The calculations in the preceeding tables estimate the health risk that would be imposed if present contamination levels were stable over time based upon the developed assessment methodology. Since ground water is a dynamic entity and nothing has been done to eliminate the contaminant source or limit leachate production, the contaminant plume will continue to move toward the Group IV homes which lie between the current plume edge and Lake Bemidji. The leading edge of the plume, moving at 400 feet per year will be detected in Group IV homes within one year and will reach Lake Bemidji within two years. It is anticipated that the higher contaminant levels and the calculated excess risk levels found in Group I will encompass Group II within 2.5 years, Group III within 7.5 years and Group IV within 8.75 years if remedial actions are not taken at the source. In addition, it must be noted that the health risks calculated in this assessment do not take into account inhalation and skin contact exposures. Such exposures are routine through showering, bathing, etc., but the associated health risks are unknown.

CONCLUSION:

This endangerment assessment shows the continued deterioration of ground water quality in the affected area of Northern Township between Kummer landfill and Lake Bemidji, and that the water quality poses a significant risk to human health. The health risk of the affected area is approximately three excess cancer deaths per 10,000 population. The trend of the plume indicates that contaminant levels will most likely increase and that more homes will become contaminated. As a result of the risk calculations above and the projected increases, the risks associated with the "No action" alternative are unacceptably high.

REFERENCES

U.S. EPA, 1980, Water quality criteria documents, availability 45 FR79318-79379, November 28, 1980.

U.S. EPA, 1984, Relative carcinogenic potencies among 54 chemicals evaluated by the Carcinogenic Assessment Group as suspected human carcinogens, Table 11-36 in health assessment document for polychlorinated dibenzo-p-dioxins, review draft, Environmental Criteria and Assessment Office, Cincinnati, May, 1984, EPA-600/8-84-014A, 592 pp. NTIS #PB 84-220268.